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IDENTIFICATION OF THE MAIZE MOSAIC VIRUS IN THE UKRAINE

by

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Summary:

Identification of the maize mosaic agent is performed studying its host plants, ways of transmission properties in sap and morphology.

Comparison of these properties with those described in literature resulted in establishing the fact that the virus isolated in the Ukraine is identical to that described in Europe (the maize mosaic virus) and the USA (the maize dwarf mosaic virus) as well as to the maize mosaic virus which is distributed in the Krasnodar territory.

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Viral diseases of the maize are very common in different countries all over the world where this crop is being cultivated, and cause huge economic losses.

In the works by foreign researchers special attention is paid to the investigation to viral diseases of the maize (1-3). In the Soviet Union, maize viruses have not been fully studied. For the first time in 1964, T.S. Dubonosov and I. V. Panarin observed mosaic virus on maize crops in the Krasnodar region (4, 5). I.I. Mitrofanov has found the mosaic virus widespread in this region and described some of its properties (6, 7).

Apart from the fact that significant areas in Ukraine are sown with maize there is now word in literature on viral infections occurring in maize. The aim of our work was to

isolate and identify the agent of maize disease detected in field experiments in 1970-1971 in large maize cultivations and in maize of different kinds in the Ukraine.

The identification of the agents of the disease in laboratory was being done on specimen of sick plants which showed the symptoms one most frequently encounters in the field (mosaicness of the leaves). The agent is easily transferred to healthy plants by means of mechanic inoculation of the sap of sick plants. The symptoms of the disease caused by artificial infection were similar to the ones observed in field experiments.

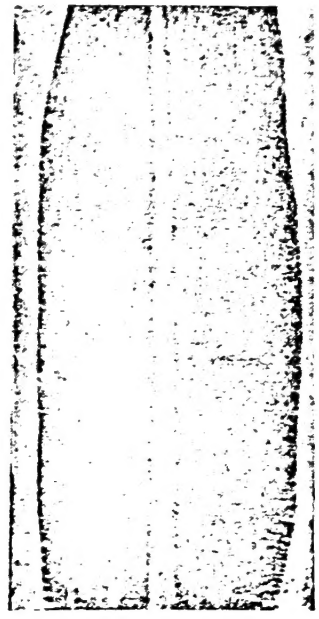

Figure - 1

Leaf of healthy maize

On being infected in the phase of 3 to 5 leaves by rubbing the leaves with the infected sap the maize showed bright irregular spots appearing on the mainly young leaves 5 to 18 days after the infection and extending to the blade. After they grew bigger they merged along the leaf vein in strips (figure 2a) and lines of yellow color (figure 2b). As a result of these symptoms spreading over the whole leaf blade chlorotic sections formed scattering on the green background of the leaf and, in the later stage of disease, the symptoms appeared in the form of green dots and strips against the chlorotic background (figure 2c). The symptoms

appeared were compared to controls which were the leaves of healthy maize (figure 1).

The agent was being transferred from the mosaic plants to healthy ones also by populations Myzus persicae, Rhopalosiphum maidis without incubation period in the carriers' organism. Special investigations have revealed that the agent of the said infection is not being transferred through the soil or seeds.

Table - 1

Plants playing host to the maize mosaic virus

Plants' name		Susceptibility
Latin name	Ukrainian name	
1	2	3
Zea mays L.	Kukurudza (Maize)	+
Sorghum halepense (L.) Pers	Gumai (Johnson grass)	+
S. vulgare Pers.	Sorgo zvichainie (Sorghum)	+
S. Sudanese (Piper) Stapf.	Sorgo sudanskoe (Sudan grass)	+
S. Saccharatum (L.) Pers.	Sorgo tsukrove (Sweet sorghum)	+
S. bicolor L.	Sorgo dvorabne	+
Setaria viridis (L.) P.B.	Mishii zeleny	+
S. glauca (L.) P.B.	Mishii sizy	+
S. italica (L.) P.B.	Mogar	+
S. Verticilata (L.) P.B.	Mishii kilchasty	+

Cont'd.....

1	2	3
Echinochloa crus-galli (L.) Roem et. Schult.	Pivnyache proso	+
Phragmites communis Trin.	Ocheret zvichainy	+
Panicum capillare L.	Proso volosovidne	+
P. miliaceum L.	Proso posivne	+
Digitaria sanguinalis (L.) Scop.	Palchatka Krov'yanka	+
Bromus scoparius L.	Bromus volosisty	+
B. danhtoniae Trin.	Bromus Danhtonii	+
B. mollis L.	Bromus myahkiy	+
B. inermis Leyss.	Bromus bezosty	-
Pennisetum glaucum (L.) r. Br.	Afrikanske proso	+
Avena sativa L.	Oves posivny	-
Triticum avestivum L.	Pshenitsa myahka	-
T. durum Desf.	Pshenitsa tverda	-
T. vulgare L.	Pshenitsa zvichaina	-
Secale cereale L.	Zhito posivne	-
Hordeum sativum L.	Yachmin posivny	-
Phleum pratense L.	Konyushina luchna	-
Trifolium pratense L.	Timofeevka luchna	-
Vicia faba L.	Boby	-
V. sativa L.	Goroshok posivny	-
Pisum sativum L.	Goroh posivny	-
Phaseolus vulgaris L.	Kvasolya zvichainy	-

Cont'd.....

1	2	3
Cucurbita pepo L.	Harbuz zvichainy	-
Cucumis sativus L.	Ogirok posivny	-
Beta vulgaris L.	Buryak zvichainy	-
Datura stramonium L.	Durman zvichainy	-
Gomphrena globosa L.	Gomphrena golovchasta	-
Chenopodium album L.	Loboda bila	-
Ch. capitatum (L.) Asch.	Loboda golovchasta	-
Ch. amaranticolor Coste et Reyen.	Loboda gigantska	-
Nicotiana tabacum L.	Tyutyun spravzhny	-
M. glutinosa L.	Tyutyun kleiky	-
Petunia hybrida Hort.	Petunia hybrida	-

Note: "+" plants susceptible to the virus
"-" plants not susceptible to the virus.

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According to literature the host plants of the maize mosaic virus are from the Gramineae family (8-10). We have tested a number of plants from among these and some other families for susceptibility towards the investigated agent. The plants were being infected by mechanically injecting them with the sap of diseased maize. The findings shown in table 1 suggest that susceptible towards the agent are the plants from the cereal family alone. Plants susceptible to the agent reacted to the infection by symptoms in which the leaves turned mosaic.

To investigate the properties of the maize mosaic virus we obtained infective sap from the leaves of the sick plants according to common method. The infective sap preserves its activity on room temperature for about one day. The agent can be inactivated after a ten-hour long heating at

50 to 53°, the final dilution of the sap being 1:500. In dry plants infectivity is completely lost.

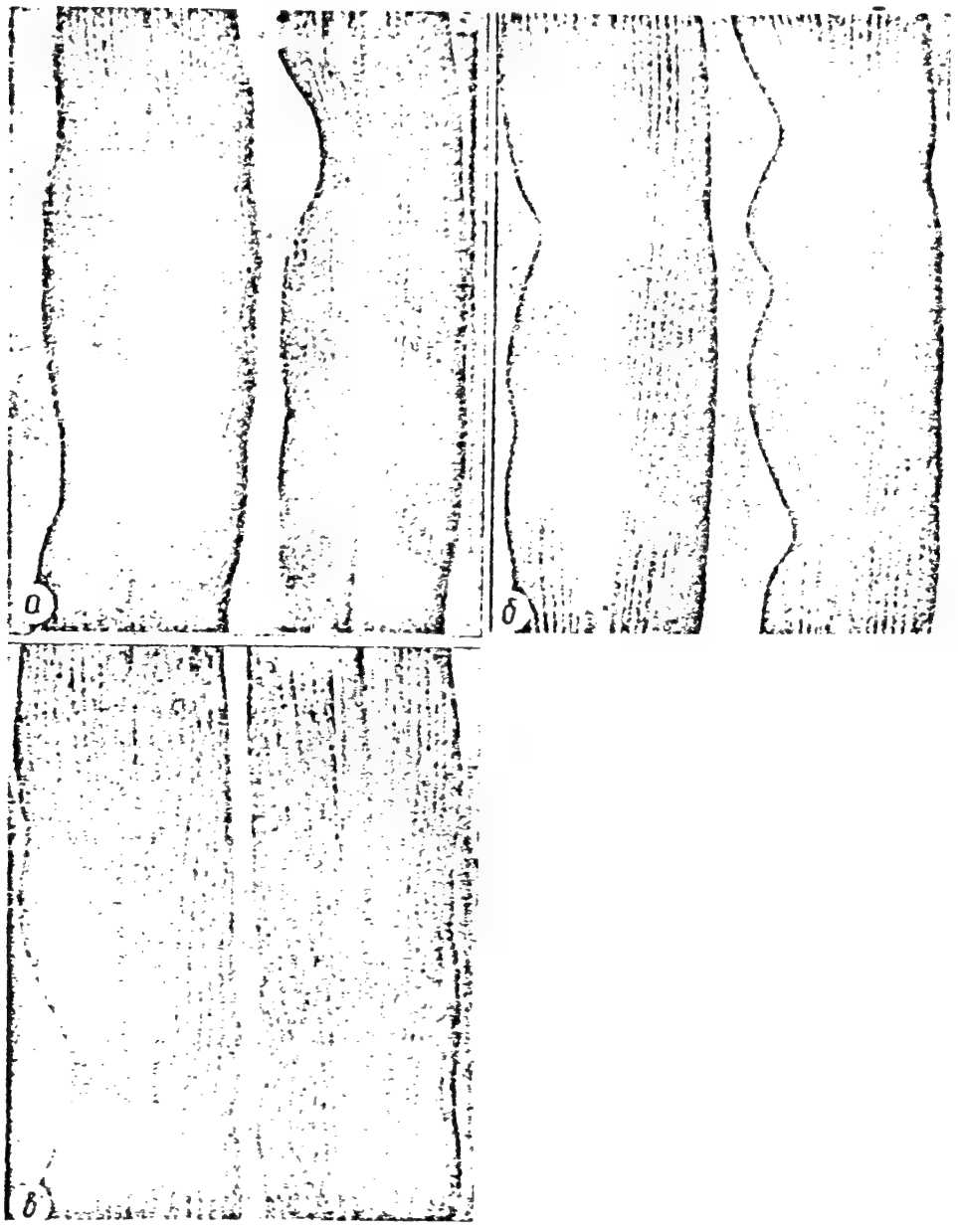

Figure - 2

Different stages of mosaicness developing on the leaves of maize.

a - bright minute spots of irregular shape, merging along with vein of leaf in stripes; b - yellow color stripes; c - formation of chlorotic spots.

For electron microscopic investigations, preparations were made from maize and sorghum leaves with clearly expressed symptoms by the method of diluted suspension (11). The sap of plants damaged by the mosaic in natural condition and in artificially infected plants revealed an identical thread like particle measuring 760 to 780 nm.

Table - 2

A few properties of maize viruses isolated from different places

Virus	Heat of inactivation	Final dilution	Preserved in dryness (days)	Length of the particles (nm)
Maize mosaic virus described in Europe	50-52°	1:1000	1	700-850
Maize dwarf mosaic virus described in the USA	50-55°	1:1000-1:5000	1-2	700-750
Maize mosaic virus described in the Krasnodar region	52-55°	1:200-1:500	1	765-780
Maize mosaic virus isolated in the Ukraine	50-53°	1:500	1	760-780

Comparison of literaturological data to ours (table 2) regarding the host plants, properties in sap and morphology of the maize mosaic virus resulted in establishing the fact that the virus isolated in the Ukraine is identical to that described in Europe (maize mosaic virus) and in the US (maize dwarf mosaic virus) as well as to the maize mosaic virus which is common in the Krasnodar region.

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